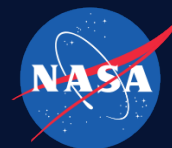


# A Battery Management and Control System using a Universal Reconfigurable Architecture for Extended Health of Batteries in Hybrid and/or All-Electric Propulsion Systems, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



## ABSTRACT

NASA seeks intelligent monitoring for hybrid and/or all electric propulsion systems, as well as methods to significantly extend the life of electric aircraft propulsion energy sources. Lithium-based batteries will continue to play a key role as an electric propulsion source due to their high energy and power densities. However, the requirement to advance towards more fuel efficient and environmentally friendly aircrafts demands battery systems that can operate for longer periods of time in a safer and more reliable manner. Efforts within the commercial aviation sector also indicate strong interest in this area. As an example, Boeing is developing hybrid airplanes as part of the Subsonic Ultra Green Aircraft project funded by NASA, and has also developed the first hybrid electric airplane in cooperation with Cambridge University. On the battery monitoring and control area, focus has been mostly aimed at achieving accurate and stable long-term estimation of cell State of Charge, State of Health, and Remaining Useful Life. These efforts have achieved excellent progress, and accuracies below 3% error are common today. We propose a new universal architecture that intelligently utilizes this estimated information and turns it into tangible actions to satisfy application demands while simultaneously improving on battery's health/life performance.

## ANTICIPATED BENEFITS

### To NASA funded missions:

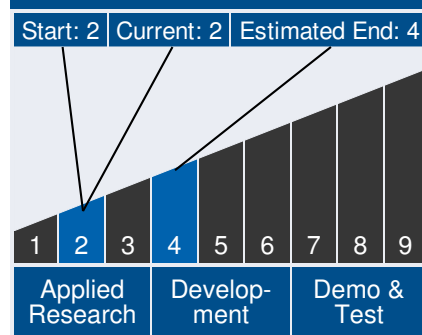
Potential NASA Commercial Applications: NASA has great interest in methods and approaches for intelligent monitoring of electric power and propulsion systems for hybrid and/or all-electric aircrafts. NASA is specifically interested in the areas of intelligent monitoring and battery life and health improvement methods for fuel-efficient and environmentally friendly aircrafts. This includes the development of battery management systems



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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

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capable to significantly extend the life of batteries while at the same time ensuring safety and performance.

## To the commercial space industry:

Potential Non-NASA Commercial Applications: We envision that the proposed system has many market applications in different industries such as space exploration, defense, and energy sectors. Other government agencies, including DOD, DOE, DOT, and commercial sectors will benefit from this technology. Additionally, battery technologies are constantly being sought for renewable systems, such as solar, wind, and hybrid and electric vehicles. Battery systems are also a critical component in Data Centers where intelligent and accurate monitoring of batteries is essential along with enhanced performance.

## Management Team (cont.)

### Program Manager:

- Carlos Torrez

### Principal Investigator:

- Carlos Rentel

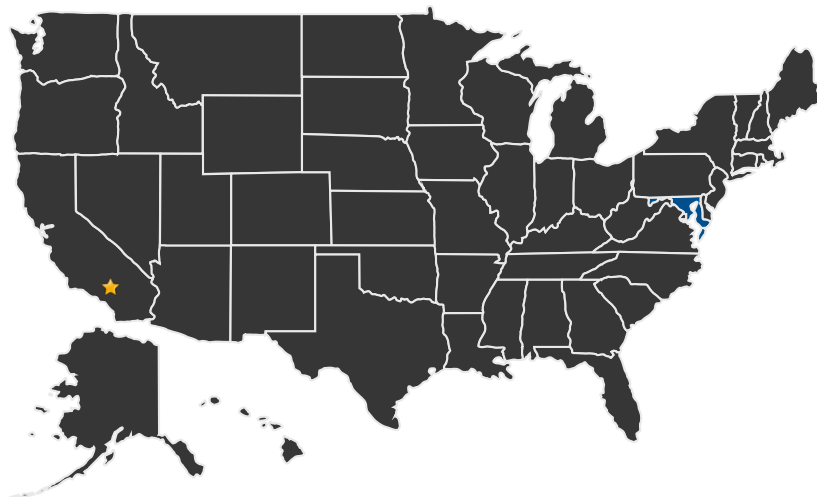
## Technology Areas

### Primary Technology Area:

Space Power and Energy Storage (TA 3)

- └ Energy Storage (TA 3.2)
  - └ Batteries (TA 3.2.1)

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ Lead Center:  
Armstrong Flight Research Center

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## Other Organizations Performing Work:

- X-wave Innovations, Inc. (Gaithersburg, MD)

## PROJECT LIBRARY

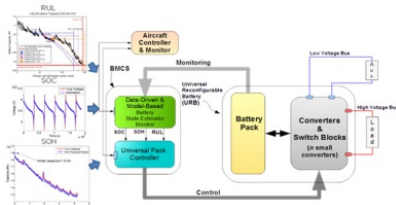
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### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/23178>)

## IMAGE GALLERY

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*A Battery Management and Control System using a Universal Reconfigurable Architecture for Extended Health of Batteries in Hybrid and/or All-Electric Propulsion Systems, Phase I*

## DETAILS FOR TECHNOLOGY 1

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### Technology Title

A Battery Management and Control System using a Universal Reconfigurable Architecture for Extended Health of Batteries in Hybrid and/or All-Electric Propulsion Systems, Phase I

### Potential Applications

NASA has great interest in methods and approaches for intelligent monitoring of electric power and propulsion systems for hybrid and/or all-electric aircrafts. NASA is specifically interested in the areas of intelligent monitoring and battery life and health improvement methods for fuel-efficient and environmentally friendly aircrafts. This includes the development of battery management systems capable to significantly extend the life of batteries while at the same time ensuring safety

Active Project (2016 - 2016)

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and performance.